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WINNERS AND LOSERS: CREATIVE DESTRUCTION AND THE STOCK MARKET

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Aggregate shocks

- neutral TFP $x_t$
- ‘embodied’ shock $\xi_t$ that improves new vintages of capital

Idiosyncratic shocks

- **Households**: uninsurable innovation risk $dN_{i,t}^l$
  - embodied shock $\xi_t$ amplifies idiosyncratic risk
  - similar to Constantinides and Duffie

- **Firms**: time-varying ability to turn innovation into projects
  - generates cross-sectional firm heterogeneity
Preferences

- Epstein–Zin (high estimated IES and risk aversion)
- preference for relative consumption
  - magnifies SDF exposure to redistributive shocks
- random death shocks at rate $\delta^h$
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Wealth accumulation

- wealth share $w_{n,t} = W_{n,t}/W_t$ conditional on survival

\[
\frac{dw_{n,t}}{w_{n,t}} = \delta^h dt + \frac{\lambda}{\mu_i} \frac{\eta \nu_t}{W_t} \left( dN_{i,t} - \mu_i dt \right)
\]

- $dN_{i,t}$ counts innovation arrivals
- $\nu_t$ value of a newly created project (function of $\xi_t$)
- $\eta$ share of project value retained by innovator

- wealthy households lived long and innovated a lot
Tradable household wealth $W_t = V_t + G_t + H_t$ (traded in complete markets)

- $V_t$ market value of existing projects in firms

$$V_t = \int_0^1 E_t \left[ \sum_{j \in \mathcal{I}_{f,t}} \int_t^\infty \frac{\Lambda_s}{\Lambda_t} \pi_{j,s} ds \right] df$$

- $G_t$ market value of investment opportunities that accrues to shareholders

$$G_t = (1 - \eta) \int_0^1 E_t \left[ \int_t^\infty \frac{\Lambda_s}{\Lambda_t} \lambda_{f,s} \nu_s ds \right] df$$

- $H_t$ market value of human capital

$$H_t = E_t \left[ \int_t^\infty e^{-\delta^h(s-t)} \frac{\Lambda_s}{\Lambda_t} W_s ds \right]$$

Incomplete markets for value of new projects $\eta \nu_t$ retained by innovators
A **firm** is a collection of projects with different vintages

- profit flow for project $j$

  $\pi_{j,t} = \max_{L_{j,t}} \left( u_{j,t} \exp(\xi_{\tau(j)}) k_{j,t} \right)^{\phi} (e^{x_{L_j,t}})^{1-\phi}$

- $\tau(j)$ is the inception time of project $j$
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- $\tau(j)$ is the inception time of project $j$

**Project size** $k_{j,\tau(j)}$ chosen at project inception

\[
\nu_{\tau(j)} \equiv \max_{k_{j,\tau(j)}} \left\{ E_t \left[ \int_{\tau(j)}^{\infty} \frac{\Lambda_s}{\Lambda_t} \pi_{j,s} \, ds \right] - k_{j,\tau(j)}^{1/\alpha} \right\}
\]

- convex cost
- once project created, capital only depreciates
- the only dynamic decision related to innovation in the model
Probability of receiving a project varies over time

- 2-state Markov chain, arrival intensities $\lambda_H > \lambda_L$, transition probability

$$
\begin{pmatrix}
-\mu_L & \mu_L \\
\mu_H & -\mu_H
\end{pmatrix}
$$
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This generates ‘growth’ and ‘value’ firms

- growth firms are those with **high arrival intensity** $\lambda_f$
  - high chance of getting new project is insurance against $\xi$ shock
- also those will **small existing size** $k_f$
  - a new project in a large firm makes less of a difference
Risk premia are generated by interaction of

- **exposures** of cash flows to risk
- investor **compensations** for these exposures
- e.g., linear factor models

\[ E \left[ R_t^i - R_t^f \right] = \sum_k \beta_k^i \lambda_k \]

- in a nonlinear model, this is a complicated object
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**Borovička, Hansen and Scheinkman (2011, 2014)**

- **shock-exposure elasticities**: sensitivities of expected cash flows to shocks
- **shock-price elasticities**: compensations per unit of exposure
- functions of cash flow maturity \(\Rightarrow\) **term structure of risk**
A. Response to $x$: disembodied shock  

B. Response to $\xi$: embodied shock

- **Term structure of risk prices** essentially flat
- frequent outcome under recursive preferences
- slope in term structure of **risk premia** must arise from shock exposures
A. Response to $x$: disembodied shock

- Output
- Investment
- Consumption
- Dividends
- Labor income

B. Response to $\xi$: embodied shock

- Output
- Investment
- Consumption
- Dividends
- Labor income

- dividend exposure to $\xi_t$ increases, interacting with negative price elasticity
- $\rightarrow$ downward sloping term structure of risk premia
SHOCK-EXPOSURE ELASTICITIES AND VALUE PREMIUM

A. Response to $x$: disembodied shock

- **Profits** (% change)
  - Growth firms (solid) less exposed to disembodied shock $x_t$
  - ... and more exposed to the embodied shock $\xi_t$ (negative price!)

- **Investment** (change)

- **Dividends** (change)

- **Market value** (% change)

B. Response to $\xi$: embodied shock

- **Profits** (% change)

- **Investment** (change)

- **Dividends** (change)

- **Market value** (% change)

- **CAPM failure**: difference mainly in $\xi_t$ (risk premium generated by $x_t$)
Generating the value premium

- heterogeneous exposures to the embodied shock $\xi_t$
- embodied shock must carry a meaningful price of risk
Generating the value premium

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Exposure of the SDF to $\xi_t$

- **aggregate consumption** not sufficiently exposed
  - $\xi_t$ is partly a redistribution shock
- interaction of **uninsurable idiosyncratic shocks** with $\xi_t$ needed
- amplification through **keeping-up-with-the-Joneses** preferences
**Median/mean consumption** generated by the mechanism

- these households are likely not the innovators
- rather look at inequality in the right tail (exclude non-innovators)
- median/mean perhaps more related to human capital (job polarization)
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Persistence $\mu_L$ of high innovation state and arrival intensity $\lambda_H$

- strong asymmetry in persistence $\mu_L = 0.283$, $\mu_H = 0.015$
- strong asymmetry in arrival intensity $\lambda_H = 8.588$, $\lambda_L = 0.122$
- support in the data on persistence of growth/value sorting?
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**Size v market-to-book**

- In the model, high $k_j$ firms should have higher expected returns
  - arrival of a new (small) project matters less for a large firm $\Rightarrow$ less insurance
- test on the 3-factor model?